BY SUSAN K. KUBANY

MUSINGS ON
COMMUNICATIONS WITHIN THE
OCEAN RESEARCH COMMUNITY

Then and the Future

LONG BEFORE science communication began to travel the Internet, ocean scientists had Omnet. The history of communications within the ocean research community is rooted in the story of my marriage to and life with Bob Heinmiller, the company we built together, and the passion we shared for a new technology—a cutting-edge technology—far-reaching in its implications for ocean science, especially in 1980.

Bob and I spent 24 hours a day together, were married (legally…? illegally?) three times in two states (with no intervening divorces—we didn't just want to renew the vows, we wanted to *get married* again), and each wore three rings. His motto at the second wedding was, "Anything worth doing is worth doing to excess," and at the third, "Marrying the same woman eliminates the learning curve." A fourth wedding was planned for 2008.

We both were at home with intensity, tumbling through the rabbit hole into Wonderland.

THE EARLY YEARS

In 1979, Bob Heinmiller was finishing eight years of exhausting communications coordination work as executive manager of the joint US/USSR ocean research program POLYMODE. Communications had been a nightmare—almost exclusively telex and, from the Russian end, usually late with needed visas, permissions, and information. (The program was high profile enough and sufficiently stressful that Admiral Edward Snyder, Oceanographer of the Navy, presented Bob with an engraved plaque for his work, "in deep appreciation.") As POLYMODE was winding down, a new program was beginning: PEQUOD, the Pacific Equatorial Ocean Dynamics Experiment.

PEQUOD was another large-scale program with a couple of dozen researchers scattered around the country, plus a few in Canada and Australia. Five time zones separated the program's two co-chairs, Jim Luyten at the Woods Hole Oceanographic Institution (WHOI) and Dennis Moore at the University of Hawaii. Another communications nightmare was looming.

Bob read a small newspaper notice: the FCC was preparing to deregulate the public data networks, to make it lawful to send words through the pipes, not merely data. It would signal the birth of the electronic mail industry. Bob went to Jim and Dennis with an idea for a proposal to NSF: fund an experiment in electronic mail with this intrepid bunch to see if it improved communications, if it enhanced the science.

The proposal was funded, but it was only the beginning of a series of molehills that needed to be scaled or stomped, sometimes both.

Bob's research on the fledgling industry led him to conclude that Telenet with its Telemail service was the best option. A local Telenet technician showed up at Bob's office at the Massachusetts Institute of Technology (MIT) for a half-day training session and dropped off a 500-page manual. For a mere $2500 per month minimum, Bob had purchased the right to set up and configure his own network, an expensive and complicated undertaking that even major corporations might find daunting, a significant molehill for small groups with limited budgets. Well, this was a National Science Foundation experiment.

After Bob figured it out, he needed to explain electronic mail to the PEQUOD group. The challenge was to show how, unlike the point-to-point communications of the phone, email was sent to a "post office computer" to be retrieved when convenient from any location using a local access number. (The presumption, of course, was that you were lugging around, or had access to, a 30-pound dumb print terminal, sans any stored memory.)

This prospect was not greeted with universal enthusiasm (another molehill), but Bob was patient and a good teacher. Slowly, the group came 'round. More important, Bob's understanding of the importance of the technology—especially for far-flung ocean scientists facing ever-growing research programs—was infectious, and the word kept spreading. First response might be negative: "I can't pay those exorbitant minimums and don't have a free person to learn how to configure the technology," someone at NASA or NOAA would phone. But then, "However, if I could add five scientists to your network, I could send you a purchase order for their costs. Would you help me?" Bob began to amass purchase orders from different federal agencies in his MIT office. His enthusiasm was indeed spreading, catching on.

THE GENESIS OF OMNET

As purchase orders for electronic mail service flowed into Bob's office, MIT began to complain: "Are you running a business here? We don't do that." So, with their help and the blessing of Carl

> "a center without walls, in which the nation's researchers can perform their research without regard to geographical location..."

Wunsch, Bob and I transitioned his "business," consisting of about 50 people (too many of whom had no equipment and had never logged into their accounts) to the third floor of our home. Bob retained an appointment at MIT, continuing his program management

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responsibilities, and I continued to run my public relations consulting business. But, Bob's excitement about this new technology had infected me as well: this would be our future. He lived and loved that intellectual challenge night and day.

SCIENCEnet was becoming an integral part of the scientist's workday.

Bob invented the company name Omnet from the Greek omni and net, short for network. We couldn't afford a phone line for business, so I asked for a new listing for our existing residential line in the name of my roommate, Natalie Ernestine Omnet (pronounced Om–nay) and, sure enough, a listing for "Omnet, NE" soon appeared in the Boston phone book and was available from directory information.

Omnet was incorporated on my birthday, April 2, 1981, and that month Bob made his first big sale; it was to the UNOLS consortium. It was about 20 mailboxes, increasing our total head count by almost 25%. "I could sell refrigerators to Eskimos," he said, laughing and dancing around the room. "I was so good!"

One not-so-apocryphal story of Omnet's founding is that Bob wanted a computer. Being limited to a typewriter was constricting the abilities of his mind, a good friend of his (apparently) told him. I said no. Ever the creative problem solver, he told me, "But, it won't cost us a dime. This is a business expense!"

I acceded reluctantly, but lovingly,

and we acquired one Intertec Superbrain with 64 kb of memory. It sat on an extra desk in our third floor offices for shared use by the two of us and our "girl Friday," Maliz Finnegan.

Everyone had a typewriter. If appropriate, someone needing to use the computer would use the spare desk.

Rapidly, I learned about word processing and, more exciting, SuperCalc, which negated my need for large pieces of paper, pencils, and erasers when doing spreadsheet projections. Bob taught me how to do spreadsheet check sums and, even in those early days, warned me about the dangers of believing in the truth of numbers that might have underlying faulty formulas, without verification using the always important check sums.

Bob continued to work at MIT "half time"—almost 40 hours a week, managing PEQUOD and, also, Jim McWilliams's new Drifters program. He continued to go to sea on research cruises, as well, sometimes for as long as a month. When asked, he even went to the Indian Ocean to make certain Charlie Eriksen's equipment was safely recovered en route to his PhD. "We need you here!" I said. "And, who's paying you?" Bob shrugged and went anyway.

Later, under the auspices of Omnet, he managed the World Ocean Circulation Experiment (WOCE) program for

Worth Nowlin. When he wasn't doing that, he automated our customer database and wrote our first billing program.

Everyone wore many hats in those days and, acting as Bob's secretary, I wrote on his behalf to a group of researchers asking if they needed travel reimbursement funds for an upcoming Tropic Heat meeting. In those days, long before the advent of the term spam, my message, sent to C.Erikson instead of Charlie Eriksen (with an "o" instead of an "e"), garnered me a reply from some executive at GTE headquarters telling me that, yes, he did, in fact, require reimbursement for travel and would I please—cough, cough—refresh him about the agenda for this Tropic Heat meeting? When we realized my mistake, I wrote back, jokingly, that, no, we would not pay his travel and, should he show up at the Tropic Heat meeting, he would not be admitted. I know of no other incident of "spam" in those early years.

One day, somehow, our lone "public" computer became trapped behind my desk, inaccessible to others, and it was apparent we needed more. I had learned: computers were good. Each of us got his or her own Superbrain; next, Bob wanted to network them, and we bought, used, a Corvus 10-megabyte hard disk drive. "I don't understand," I lamented to the friend we bought it from. "How much memory is 10 megabytes—*Moby Dick*? The *Brittanica*? How much?" "Ten megabytes is more memory than you will ever, ever need!" he exclaimed. And Bob beamed. The computer power Omnet had on the third floor of our home rivaled that of his beloved MIT.

My vision for Omnet involved using revenues from the science side of the house to sell electronic mail to

businesses. If it is this useful to the ocean science world, I reasoned, surely it will be equally useful to far flung advertising agencies and law firms, with offices scattered around the country or, even, around the world.

Sadly, computers were not ubiquitous enough. Those were the days of Wang word processors and the like—understood by secretaries, but eschewed by management. And, to the extent we sold to businesses at all, the functionality too much resembled telex—hand write a note, give it to the secretary to type and transmit to a destination where it would be downloaded by a secretary on the receiving end, printed, and placed on the desk of her manager.

I signed up for a booth at a business fair in Boston in early 1982, hoping to launch the commercial side of Omnet. I printed thousands of oversized flyers on newsprint cheaply enough so that we could afford to thrust them at everyone with the hope that some few might read about the inherent possibilities. We took turns hawking the sheets. Maliz, our beautiful young assistant, was handing out flyers: "Electronic mail information?… Electronic mail information." Hand a flyer. "Electronic mail?" Hand a flyer. A man walking past the booth accepted a flyer, stopped and turned around, looking bemused but, obviously, interested. "Electronic female?" he queried. No one understood email. Male? Female? Mail?

(Interestingly, William Buckley was an early adopter of electronic mail and used our "business service" to communicate for many years from his summer home in Switzerland back to *National Review* magazine.)

Although adoption of the technology was frustratingly slow, even in the ocean sciences world, there, at least, like the game of Life, the growth was organic: every new group of five overlapped with, at least, some colleagues already on the network. The more overlapping and adjoining cells in the network, the more useful SCIENCEnet became for all. (Certainly, that was not true for small, closed, insular business networks.)

Bob and I doggedly lugged our 30-pound "portable" print terminal around to NASA, NOAA, ONR, NSF, and other DC-based agencies, demonstrating the wonders of computer communications, even in the humid, hottest days of August. "Please, let me carry it for a block… you are so wet and tired…," I pleaded, trudging along in my high heels.

Providing service to sometimes short-tempered scientists who were long on an understanding of science but short on knowledge of technology was a challenge. We supported myriad operating systems and software packages. We developed a card file of systems and software, including the names and phone numbers of "experts" we had identified within the community who might be able to help us if we were stymied with a question about software or equipment they were using. Bob made my card file into a searchable database.
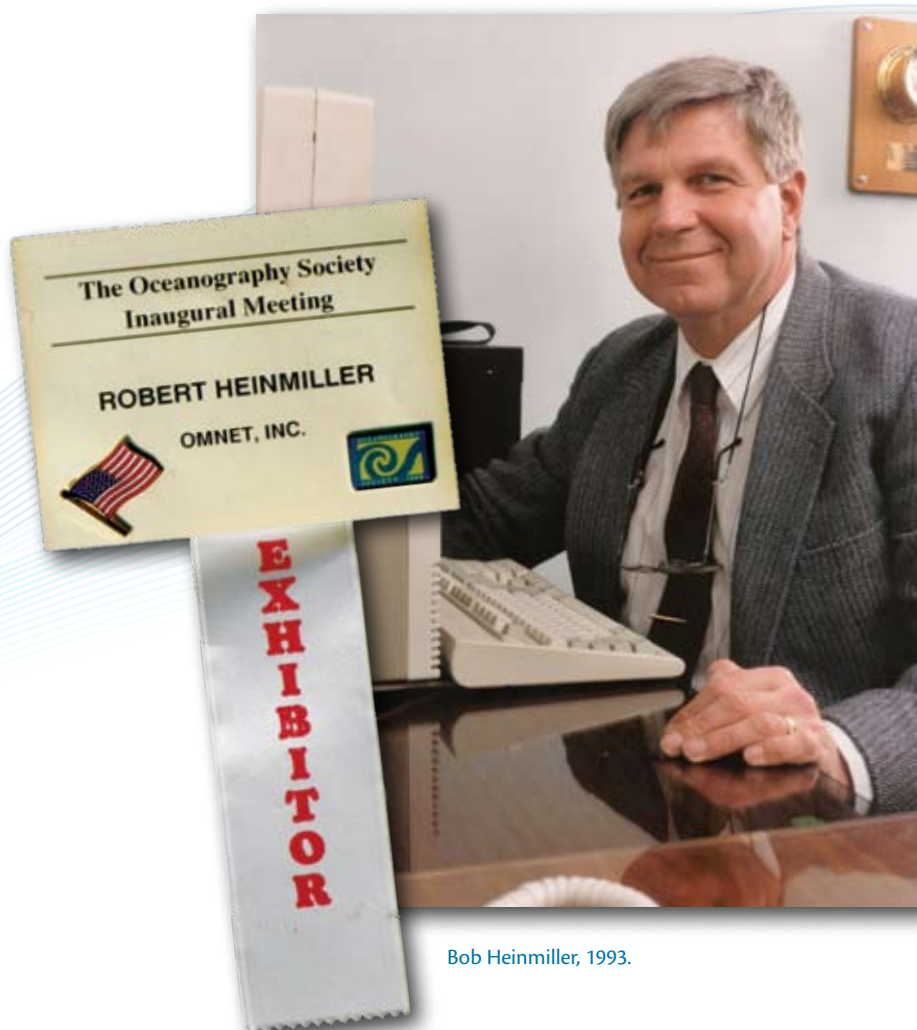
Bob Heinmiller, 1993.

My admonition from the beginning was that we would always provide explanations in plain English, not in incomprehensible "tech speak," knowing that these people had no easy access to local technology experts. X-on/X-off handshaking needed to be set—and understood—by the users themselves. My favorite metaphor was the drink of milk: you can't pour milk endlessly into your mouth. After filling your mouth, you need to stop, pause, swallow. One stop bit off: swallow now. See? Losing data? Let's try two stop bits off. Maybe something is dribbling out of the corners.

I taught our small customer service force, none of whom had touched a computer before coming to work for Omnet (in those days computer experience was exceedingly rare, at least among those who were literate in a conventional sense) that the most irate customer was most likely to be our strongest supporter, ultimately. We might get a phone call from someone screaming, "Cancel this account! It doesn't work! I followed all your instructions exactly and this network is useless, useless, useless!" Stay calm, I cautioned our employees. Speak softly. Ask him, gently, to describe, please, what he is doing, what, exactly, doesn't work. All those calls ended with a contrite, stammering apology. Both Bob and I loved it and found it emotionally and psychologically rewarding.

Bob's inventive mind and mastery, years earlier, of his original 500-page Telemail manual proved useful, time and again. Soon, he began to take software designed for one purpose and script it to do things never originally intended but more appropriate for an associational use: public and private bulletin boards, directories, discussion groups, online

searchable manuals, and more. "I know more about this software than they do," he told me of the company GTE Telenet, which had since purchased the Telemail software system.

The critical mass we were achieving spawned the need to expand, change. "But my colleague just won't use it! I don't know what to do!" So, Bob invented LUDDmail: Low Utilization Direct Delivery (in honor of Ned Ludd, who led the fight against automation in the early 1800s). LUDDmail: send us a message intended for a colleague; we will print it, put it in an envelope, put a stamp on it, and send it to him.

SCIENCEnet was becoming an integral part of the scientist's workday. Even beyond a routine workday, it was encroaching. All of the company chuckled when Mel Briscoe's bride, Ellie, sent us a picture of him, poolside, on his honeymoon in the summer of 1983, checking SCIENCEnet to keep in touch with his physical oceanography work at WHOI.

THE GROWTH AND LEARNING YEARS

By 1986, we still had fewer than 1000 subscribers, but this technology was better than anything that preceded it. Someone posted a message on the Ocean bulletin board and a wandering ARGOS buoy in the South Pacific found its mother. A hurricane near Tahiti washed more than $100K of instrumentation overboard from a Scripps research vessel, but a SCIENCEnet posting reassured us that all on board were safe (including Chief Scientist Bob Heinmiller).

We added "alias listings" for shared mailboxes and improved the search

capability of our online help. Richard Vetter moved his famed Vetter Letter to an electronic venue under the auspices of SCIENCEnet.

In 1987, we created a photo album of Omnet employees (we numbered 16 at peak strength), including biographies, which we carted to professional society meetings so users could see and read about the Omnet people they worked with, and we took home Polaroid pictures of the scientists who chatted at our booth to help our employees better understand the people behind the messages and phone calls.

Although the committee was most certainly formed years before, in 1988, the National Research Council published *Toward a National Research Network*. "The United States would benefit significantly from the creation of a national research network," the booklet intoned at its beginning. But, ocean sciences already has it, Bill Emery insisted, demanding to include a discussion of Omnet's SCIENCEnet in the report. Other members said it was inappropriate, even, to mention a commercial company in a National Academy of Sciences document. Bill Emery's tenacity won out and a compromise was achieved: a modest mention of a useful and powerful, but unnamed, network, "created by a former oceanographer and his wife." It was our first marquee.

A group of climbers, loosely affiliated with the National Center for Atmospheric Research (NCAR) in Boulder, planned an ascent of Mount Everest, lugging equipment with them to receive weather reports from the University of Pennsylvania via SCIENCEnet. When they reached the summit, the "Cowboys on Everest" sent

a message to SCIENCEnet's NSF-funded mailbox, South.Pole, and, for the first time, the world was connected top and bottom. It was another first.

The American Geophysical Union (AGU) initiated Kosmos in 1986, although it did not register as a cataclysmic event on Omnet's scale until 1987. AGU had, finally, begun to notice electronic mail. AGU Executive Director Fred Spilhaus opened a SCIENCEnet mailbox and, from its first creation, we regaled him with sugarplums of the AGU services we could make available to SCIENCEnet subscribers in cooperation with him.

Cooperation was not on his agenda. Fred rejected an informal proposal we submitted and, later, a formal proposal submitted in April 1986. Its beginnings were rough-edged, but the society had massive financial resources and, with the *Eos* newsletter, potential to communicate with the geophysical community worldwide.

As I adroitly outlined joint possibilities during a meeting's opening icebreaker party, he said "Susan, you are where the money is" and walked away. Without the cooperation of AGU and its vast financial resources, it seemed there was little to do but wait for the inevitable death of SCIENCEnet.

In February 1988, Harmon Craig from Scripps, a new SCIENCEnet subscriber, asked about Kosmos and SCIENCEnet. Attempting to answer him, honestly, but not prejudiciously, we provided a technical response. He persisted with probing questions until the customer service folk kicked Harmon up to me. My answer was also accurate albeit circumspect, but Harmon was piecing the technical snippets together. "They are competing
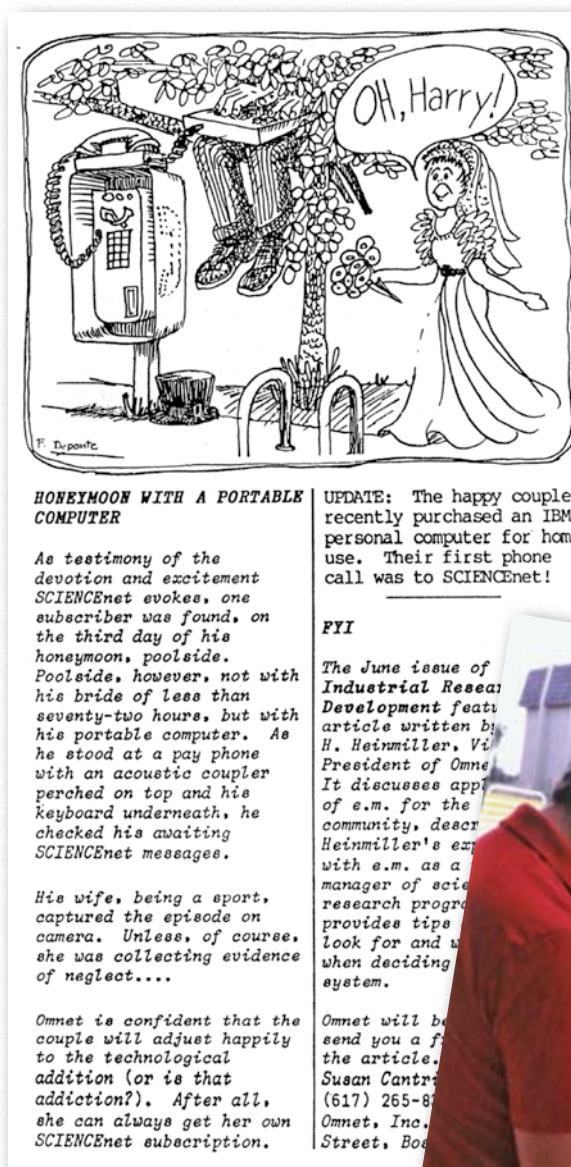
with you, aren't they?" he wrote to me. "Yes," I allowed, "they are."

Harmon posted a message on the Ocean bulletin board in February 1988: OMNET CHRISTIAN SOLDIERS: MARCH! It began: "Some of you are aware of the increasing effort by AGU to swallow SCIENCEnet that many of us are using regularly…" He copied Fred Spilhaus, the presidents of the various AGU sections, and Arnold Gordon and Barbara Hickey in ocean sciences.

Thus, the bulletin board, AGU.Forum—one of the most popular ever—was created, where SCIENCEnet members made an open appeal to AGU to cooperate with Omnet. It was a wonderful, heady time for us as person after person chided and implored Fred Spilhaus to work with Omnet, and an understanding of the technical, political, and financial implications of the dueling

services was becoming clearer.

In March 1988, The Oceanography Society (TOS) was incorporated. Jim Baker's article, "How The Oceanography Society Came to Be: Its Background and Its Future," in the inaugural issue of *Oceanography*, thanked Omnet for supporting the formation of TOS and, beyond the article's list of unmet community needs, one quiet paragraph mentioned Omnet: "We also agreed that electronic mail will be an important aspect of the activities of the new society. There is unanimous agreement among the organizers and from the respondents that we should use electronic mail as a prime medium of communication, and that we should work with Omnet, which has led the ocean community into the electronic world."

I was proud of the birth of TOS and of Omnet's contribution to the process, but we weren't done yet. A competition for the creation of a society logo was launched and the beautiful, flowing waves of the present TOS logo was the winning entry from Omnet. Has it really been 20 years?

In 1988, Lee Sproull and Sara Kiesler (they coined the term "flaming"), the nation's two leading electronic communications researchers, asked permission to study SCIENCEnet. Of course! This was heady stuff: a peer-reviewed article about SCIENCEnet. They posted a community-wide message inviting participation and, with Bob's help, developed a randomly selected list of high-, medium-, and low-volume users to pursue separately. Data collection began in the fall of 1988 and concluded in the spring of 1989. The paper, "Returns to Science: Computer Networks in Oceanography," was "the first systematic

assessment of the value of computer networking for a scientific community," published in *Communications of the Association for Computing Machinery.* In the typically understated tone of peer-reviewed publications and explanations of multivariate regression techniques, the conclusion translated loosely to be that SCIENCEnet was an "upside-down" network. Whereas in most studies, the disenfranchised—mail clerks, students—used computer communications the most, SCIENCEnet was the opposite. With a phenomenal (my word) survey response rate of 84% for both high and above-median usage groups and a scant, but very important (my words), 3.5 messages/day average, the highest-volume users were the most distinguished members of the community: "they work at more prestigious institutions, have received more professional recognition, have published more and know more oceanographers."

In 1989, John Woods at the Natural Environment Research Council (NERC) in the UK asked to meet with us. It was a short meeting. He apologized, but he had an emergency meeting with Margaret Thatcher following. His message was brief, but unambiguous: Omnet needs a European presence, a way to protect the highly visible European entities that need SCIENCEnet, but might be chastised for "buying American" by the new pan-European community.

Still in technological infancy, the concept of a virtual umbrella under which one shared resources and information was little understood, except in theory, outside of SCIENCEnet. "Just send messages," the Europeans were being told, but John Woods knew that would not be sufficient; thus, Omnet Europe was

created, operating out of a cottage on Loc Derg in County Clare, Ireland, with one employee, Louise Delaney, accepting and processing European purchase orders from high-profile European institutions and agencies—Cambridge, Oxford, Centre National d'Études Spatiales (French space agency), the Intergovernmental Oceanographic Commission (IOC)—and transmitting them to Omnet headquarters on the second floor of a house in the Dorchester section of Boston, Massachusetts.

An affiliation with ATI/Telemail in Japan followed shortly thereafter, a wonderful personal as well as professional relationship, beginning one day when I received an international phone call that began, "How did you people become so famous in Japan?"

Japanese scientists from JAMSTEC (Japan Agency for Marine-Earth Science and Technology) and elsewhere, like their European counterparts, did not wish to subscribe to the Japanese Telemail service, pushing messages over an electronic transom into the SCIENCEnet room; they wanted to be inside SCIENCEnet with access to all of its wonders. (On our first trip to Japan, Hiro Kotani, ATI's general manager, declared me an honorary man and took Bob and me to dinner followed by a karaoke bar where a waitress sat on the floor at our table refilling our glasses so late into the night I could barely make it into the cab back to the hotel. It was a wonderful time.)

In February 1991, Bob created *Om-newserous: All the news that's fit to eat*, an in-house newsletter with technical tricks, lessons learned, admonitions about conservation of resources from postage to paper, and information about

BOX 1. ON THE PERSONAL SIDE

Bob Heinmiller came out of the Florida everglades in the late 1950s, a hick on a full-tuition scholarship to MIT as a National Merit Scholar with a perfect SAT score of 1600. He arrived with $100 in his pocket, borrowed by his parents from his aunt to last for the next four years. He worked throughout his college career at assorted jobs, from campus guide to male model, pumping gas, and popping pills "for science" at Harvard.

After graduation in 1962, with a degree in physics, he accepted a job at WHOI, so that "I could learn to sail, solo, around the world," he later told me. His first job was as a research assistant working in the Theoretical Oceanography and Meteorology Department with Eric Kraus and Columbus Iselin, Department Chair (and previously WHOI's Director, twice). Next, he went to the Applied Oceanography Department in July 1964 to work with Earl Hays and others on the moored array program, servicing current meters and other instruments for deployment on moorings. He assumed responsibility for the buoy operations group and all its at-sea operations in 1966—when he was only 26 years old. By the time he left in 1973, he had built the WHOI Buoy Group into the most respected deploy-and-recover operation in the world.

George Tupper, now retired from WHOI, wrote, "Bob was the guy who hired me in the summer of 1967. I was fresh out of the Air Force and pretty conservative. While I was waiting in the Smith Lobby, a blond giant of a man came through a couple of times. I noted with disapproval his long shaggy hair, his enormous walrus mustache, the blue workshirt, red suspenders, holey jeans, and scruffy sneakers. I couldn't imagine what a person like that would be doing in a world-class scientific institution. When I was summoned for my interview, I was ushered in to the office of—you guessed it—the blond giant, Mr. Robert H. Heinmiller, Head of the Buoy Operations Group.

"Bob did what I think may be one of the gutsiest things I've ever seen on my first cruise aboard the old R/V *Chain*. We were to recover several subsurface moorings and launch their replacements at the old Site 'D,' 39°N and 70°W. We had severe acoustic release problems and none of the moorings we were to recover came back. At that point, Bob said, 'We're not going to launch any more moorings until we know what we're doing,' and the ship returned to WHOI with all the to-be-launched moorings still on board.

"That was the start of the buoy engineering effort which resulted—in a very few years—in an increase in our mooring recovery rate from about 60% to 98%, while increasing the average deployment length from two months to one year."

Bob eventually sold his 65' rumrunner, *The Black Duck*, on which he lived for years, as well as his 40' round-the-world sailboat. He never attempted a solo around-the-world journey, but all who sailed with him said he was world class. He did deep ocean diving, scaled rocks, climbed mountains, and, over the years, took up, mastered, and then (too frequently) abandoned photography, stained-glass making, the complete works of various authors from John LeCarre to Patrick O'Brien, Victorian house renovation, ballet and ballroom dancing, welding, and beekeeping. Skydiving remained a love of his life from his MIT undergraduate days forward. He amassed almost a thousand jumps.

I met Bob Heinmiller on May 22, 1978, when a mutual friend brought him to a party I was hosting for a client at Boston-Boston Disco. Bob and I were married seven months later, on only two days notice, two days before Christmas, with few friends in attendance. Alan Robinson and his wife were the only ones there who belonged to the world of ocean sciences.

Weeks later, Alan invited us for dinner at his home in Cambridge. When we arrived, Alan said in a stage whisper, "I want you to know: Bob is the only man here who doesn't have a PhD."

At dinner, Bob was seated to the right of Alan's wife and I was ushered to the place of honor on Alan's right, at the other end of a very long table seating many Latin-speaking Harvard dons. After we were served, Alan looked at me and, by way of striking up a conversation, asked, "How did two people as disparate as you and Bob ever get together in the first place?" Had I been more brazen, I would have tossed the question, loudly, to Bob at the other end of the table, but there were too many unknowns in this world for me, so I blushed and demurred.

This was my personal introduction to the world of oceanography.

S.K.K.

ocean research written to enhance the understanding of our support staff.

William Wulf, Assistant Director of NSF's Directorate for Computer and Information Science and Engineering, coined the word collaboratory: "a center without walls, in which the nation's researchers can perform their research without regard to geographical location—interacting with colleagues, assessing instrumentation, sharing data and computation resources, and accessing information in digital libraries."

In 1993, the National Academy Press published a 100-page glossy booklet for the Computer Science and Telecommunications Board of the National Research Council called *National Collaboratories: Applying Information Technology for Scientific Research*. Now SCIENCEnet was no longer relegated to an anonymous footnote in a National Academy of Science publication. Rather, Omnet's entire history was documented in the report as well as the company's plans for the future, for extending the functionality of the Internet to the research vessel fleet in cooperation with SeaNet.

Bob Heinmiller's ideas and plans for the future, however, were fast exceeding the capabilities of the rapidly aging software running on our memory provider's Tandem nonstops in Herndon, Virginia. We needed something newer, but the industry was moving, along with the Internet, to distributed communications: Lotus Notes was the new commercial buzzword. It would not suffice for our purposes.

In the interim, we married SCIENCEnet with the Internet using Bob's new SAVI service (SCIENCEnet via the Internet), so that persons using

Internet pipes could still connect to the safe and useful SCIENCEnet. Then, because no one else was doing it, we began work ourselves on the next generation of SCIENCEnet software.

I was exceedingly apprehensive. It was one thing to make use of expensive and powerful infrastructure maintained by a large, redundant company; it was another for a handful of folks—however creative, resourceful and well-intended (but who needed to sleep occasionally)—to compete with the giants. "Just how many simultaneous log-ins do you think we'll need to support now?" I asked Bob, dubiously.

"We can do it," he said.

Code-named Project Fernando in honor of our deceased cat, who for years provided purring moral support to the customer service team, we began the development in 1991. The first effort, which we contracted out, failed, so we brought the development in-house, with two very smart software engineers and Bob Heinmiller at the helm, writing specs and overseeing the effort.

For a relative nickel and in only 18 months, we rebuilt SCIENCEnet, creating more powerful, integrated, multifunctional, and expandable software than anything envisioned when Telemail was first written.

Bob tested the robustness of the effort, even mock simultaneous log-ins: it worked. It would not bend or break even with expanded use. The new SCIENCEnet accommodated our lone computer terminal user in Africa and was accessible via dial-up or the Internet. Its bandwidth requirements were minimal and the software was elegantly sleek and lean.

We launched in March 1994. It was

rocky. The only rogue employee Omnet ever had sabotaged our administrative module, which allowed us to register users and vary profiles, and we experienced a teeth-gnashing month of patches, confusion, and complaints while we toggled between managing both the old SCIENCEnet and the new one.

By mid-April the software bugs were gone, and we nudged the remaining old SCIENCEnet users to move to the new system.

Omnet's revenues were plummeting, and the cash flow projections that had been my business bible for more than a decade were not encouraging me. Sometimes, in the previous dozen years, revenues had held constant at a plateau, but I had never seen revenues plummet with the rapidity they did then. We had two problems: mailboxes were being cancelled, and usage of the ones remaining was decreasing. We were straddling a widening chasm.

Had our resources been greater, we might have bridged the transition from the old SCIENCEnet to the new, but our financial reserves were exhausted. My rule since the company's inception was that Omnet would always spend less than it took in, no matter what. I broke that rule during the development effort. It was worse now.

I was emotionally exhausted. Everyone at Omnet had been stretched, for months, beyond reasonable limits in time worked and emotional commitment to the company.

On September 1, 1994, I announced a meeting and told the employees we were going to close the company on December 31. There was great sadness. It had been a good run. I wrote to our subscribers and told them the same,

giving them adequate time to plan for a communications transition. I asked them, whatever their plans for the future, to remain with us until the end to allow us a graceful financial exit.

In mid-December 1994, Mel Briscoe called while I was packing boxes and told me that he had nominated Bob for the Ocean Sciences Award. Wow.

In December 1995, Bob flew to San Francisco to receive the Ocean Science Award. The citation said that he "bravely led the way for oceanographers to enter the electronic mail era well before e-mail was fashionable," and he mounted a "pioneering effort [that] created a true sense of community for ocean scientists." When he returned, we made a pact to rebuild.

REBUILDING THE "COLLABORATORY" ON THE INTERNET

Boston was increasingly noisy and over-crowded, as well as expensive, and we found a new home in Staunton, Virginia, in the Shenandoah Valley. Staunton is only three hours from Washington, DC, which afforded us an easier opportunity to rebuild the company. In April 1996, Bob loaded a rented van with a core of Omnet belongings—desks, chairs, a couple of PCs, and three Sun SPARCstations we had used for the new SCIENCEnet service—and moved, alone. I remained in Boston to sell our house. Bob set up Omnet's new operations himself and slept on the floor of the office for the first two months.

In June 1996, although our house still had not sold, I joined Bob in Staunton.

Blessedly, soon after landing in Virginia, Mel Briscoe at ONR funded a short-term effort to recreate

SCIENCEnet on the Internet. Bob hired two programmers and started over. The software was different, but the ideas were similar to, or an improvement upon, our Project Fernando.

Bob was more energized than I, and he completed the first modules in less than six months. His plan was to add

functionality as the needs of the community grew and changed. The cacophony of the Internet was intense in the mid-1990s, however, and we learned firsthand how hard it was to make sufficient noise to be heard on the Internet.

I spent many a night staring at the ceiling, thinking about Internet marketing, what I needed to do to capture the attention, and imagination, of this worldwide herd of oceanographic cats. My frustrations continued for years and, about 1998, following a TOS meeting in Las Vegas, which I spent editing directory listings nonstop while Bob chatted with old friends, we published a 142-page "Directory of Members and Catalogue of Services: 2000," which included SCIENCEnet aliases for 8,700 scientists located around the world. (A message sent to J.Doe@ SCIENCEnet.com would be transmitted to Omnet's servers, which would redirect the message to the scientist's actual email address.)

Beyond the directory, we had a full page of international country and US

state codes, a five-page acronym list, and a description of these collaborative services: Document WorkRoom, Conferences, Bulletin Boards, Virtual Poster Sessions, Mission-Critical Mailing List Management, Fax Service, Searchable Calendar of Events, and Bob's newest endeavor, the Manuscriptorium.

At its zenith, Omnet had about 1500 log-ins each week on the Ocean.US site.

We mailed out almost 5000 copies, mostly within the US to conserve funds. It flopped. No one noticed.

In 1999, Steve Ramberg invited us to ONR. Congress wanted an Integrated Ocean Observing System (IOOS), he told us. They were tired fooling with half measures and were creating, under the auspices of the National Oceanographic Partnership Program (NOPP), a new interagency office, Ocean.US. It wasn't off the ground, as yet, but a director had been selected, and Steve asked us to help him make this IOOS happen (whatever that meant).

Ocean.US director Dave Martin was challenging, thoughtful, and determined. We began work with Dave, unofficially, for free, before a budget was approved, but our excitement was bubbling once more. An IOOS? An IOOS!

We helped outfit an office, pushed desks and chairs around, arranged for phones and Internet connectivity, and Bob traveled with Dave to meetings, wrote reports, working throughout to synchronize a vision of what this new

IOOS thing might look like. Dave liked to use his whiteboard and, mostly, Bob listened to Dave's unfolding vision.

Omnet built the first Ocean.US Web site and commissioned the design of its logo.

Both ONR and Dave Martin wrote to the National Communication and Telecommunications Administration (NTIA) to request that, when the new .US domain names were released later that year, Ocean.US was to be set aside for the Ocean.US office. Bob followed up by phone call and memo. He sent a reminder memo a week before the auction onslaught. The day came; Ocean.US was gone. Everyone was furious, demanded that NTIA reclaim Ocean.US. I believe even Admiral Lautenbacher fired off a message or a letter, but nothing was to be done. There were apologies all around, but GoDaddy Software in Las Vegas owned Ocean.US, which, of course, was up for sale to the highest bidder—at the time, bids sometimes went to hundreds of thousands of dollars. However, after about four months of patiently biding my time, I managed to negotiate purchase of the Ocean.US domain for about $500 (still a sizable amount given the limitations of our support contract).

Larry Atkinson was asked to join the fledgling Ocean.US staff, and he traveled to Staunton to talk with Bob. "Is this going to be different, do you think, really work?" Bob and I both nodded enthusiastically. "Yes, this is a new beginning. There will be an Integrated Ocean Observing System. It will happen."

As we continued the struggle to put the SCIENCEnet Humpty Dumpty back together again, wondering how we might ever get one thousand or ten thousand scientists to pay a buck or two for our labor, it became apparent we might marry our ONR development with our Ocean.US efforts and create a more useful Web environment, a small piece of this IOOS thing, a collaboratory where people talked about research, about data, about IOOS. We merged the Ocean.US Web site with our development, dumped the SCIENCEnet.com alias, substituted Ocean.US, and were off and running.

By combining this fledgling Wulfian "collaboratory" with the mandate and visibility of the Ocean.US office and its IOOS thing, we hoped to bring people to the Ocean.US site in droves, on a regular and ongoing basis. Our vision was not merely a site with static "founding documents" and semi-annual updates, but a vibrant place that changed week-by-week, if not day-by-day, of practical everyday use to members of the community.

At the suggestion of Jim O'Brien, who patiently explained "push" technology to me, we created an easy-to-skim, weekly, one page "sampler" of new information posted to the bulletin boards. If an item were of interest, a "click" would transport the reader to Ocean.US for the entire announcement, as well as everything else of interest pertaining to NOPP, IOOS, or Ocean.US. (Each week we monitored failed e-mail addresses, meticulously tracking the wayward scientists' new location or address information. Our database was the largest, most accurate, and most frequently updated directory of international ocean scientists in the world. There was no close second: God is in the details and, as always, we dealt well with the details.)

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Concurrent with our expansion of the Ocean.US Web site into an albeit modest, but functioning collaboratory, Omnet obtained Small Business Innovation Research (SBIR) funding to develop ground station infrastructure based on the Iridium satellite system—but optimized for ocean data. (Iridium was built, originally, only to accommodate voice communication.) Our Phase I work was well received, and Tom Curtin and Dave Martin helped us develop concepts for a Phase II proposal. When money was approved, Tom Nelson exclaimed, "This project is going to be the poster child for all Department of Defense (DoD) SBIR funding!"

We assembled a group of "Iridium pioneers," and distributed free modems, to help with testing of data throughput issues. Together, we would begin the development of an Iridium data knowledge base, and then provide ongoing support, dedicated exclusively to the small ocean research community market—a market no one else wanted to serve, except as part of an aggregate.

By working in collaboration with the Defense Information Systems Agency (DISA), Omnet would be able to offer the community access through the DoD ground station at one-tenth the cost of commercial providers, saving the community millions of dollars while sustaining DoD's substantial investment in Iridium.

Most importantly, all data collection would be consolidated through a single point, where we could begin to provide additional services such as feedback to agencies and data distribution. Certainly, under the auspices of Ocean.US, this was enhancing our interpretation, in a small way, of Congress's vision of the IOOS.

I've never understood why both development efforts were terminated.

And then Bob Heinmiller died at 9 pm on Monday, April 25, 2005. He was 64 years old.

THE FUTURE

Once upon a time in a world far, far away, the ocean research community had the best communications infrastructure of any science and, of course, it could use it again, but, if not, not. For other disciplines, it was a floor plan, a research paper, or a National Academy of Sciences report about possibilities. Ocean research had a powerful, effective, working, worldwide communications reality.

Having tasted it once, there are those of you who remember those days fondly, but for those who never experienced it, the white noise, spam, viruses, information overload, corrupted computer files, and tedious PowerPoint presentations are merely the way of life. The community is reverting back to often less-than-useful, real-time meetings, coffee break klatches, PowerPoint exchanges, static Web sites, and way too much spam and information overload.

Dedicated exclusively to worldwide ocean research, expandable, lean, and mean should be the operative words for any new collaboratory or IOOS development, although, even here, the vision for Ocean.US and IOOS is narrowing, not expanding.

Bob Heinmiller wrote an article when he was young about the marriage of magic and technology, how with passion and inventiveness one could personalize technology in a way that allowed it to begin to simulate magic. Present-day technology has never been better suited for building these virtual environments,

Bob Heinmiller and Susan Kubany, 1983.

but the issue is not technology. It is service—a willingness to sprinkle the anthill with sugar and an understanding of how to do it—that creates lures. Beyond building resources, one must perform tireless outreach and fold into the mix a kind of "half-off coupon" for some badly needed (like Iridium data) services.

The phone needs always to be answered by a knowledgeable person—(never a machine! *Mon Dieu*!)—and the development itself needs to be the easiest, most powerful, responsive, default resource for a wide array of community needs. Pixie dust magic is always the hard part.

If there is a an expansive collaboratory—or worldwide IOOS—in the community's future, I believe it will come from that marriage of magic and technology, of passion and devotion, not funding of another new lab, another office, another study, another program, certainly not yet another report. It will evolve over time, not be blueprinted by committee. If you sense a budding seed, want it to grow, then water and nurture it and watch wonderful new things evolve. ◩